Polypropylene – Emerging Scenario:
Dream Surge in Five Years

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Polypropylene or PP is the second most important thermoplastic after Polyethylene. Its per capita consumption is a kind of parameter used for measuring economic advancement of a country. PP capacity is poised to double up from current 4.8 MMTPA to 9.4 MMTPA in a matter of five years by 2025. This trend will penetrate in to industrial and hence economic activities across India by creating opportunities for new investments, revenue generation and employment. This article is intended to briefly capture the emerging PP scenario in next 5 years.

Polypropylene or PP is the second most important thermoplastic globally by volume, only exceeded by polyethylene or PE. PP has become integral part of our daily life through its versatile applications. PP is produced in three different types namely Homopolymer PP (PP-H), Random Copolymer PP (PP-RC) and Impact Copolymer PP (PP-IC). Impact Copolymer PP is also called Hetero-Phasic PP. The consumption of thermoplastics in general and PE and PP in particular has become a kind of economic parameter for the progress of a country.

Propylene is the main raw material for producing PP. Propylene is sourced from

Table 1: Emerging Polypropylene (PP) Capacities in India in KMPTA (Kilo Metric Tonnes per Annum)				
Company	**Location**	**State**		**Technology Licensor**
HPCL Rajasthan Refinery Limited (HRRL)	Barmer	Rajasthan	980	Lummus Novolen
Hindustan Mittal Energy Limited (HMEL)	Bhatinda	Punjab	500	LyondellBasell
Indian Oil Corporation Limited (IOCL)	Panipat	Haryana	450	LyondellBasell
IOCL	Paradip	Odisha	680	
IOCL	Vadodara	Gujarat	420	Lummus Novolen
IOCL	Barouni	Bihar	200	
Chennai Petroleum Corporation Limited (CPCL)	Manali, Chennai	Tamil Nadu	475	Lummus Novolen
Nayara Energy	Wadinar	Gujarat	450	W R Grace
Bharat Petroleum Corporation Ltd (BPCL)	Rasayani	Maharashtra	450	W R Grace
Total Capacity			**4605**	

upstream plants which are of following types:

- Naphtha Cracker – the most conventional source or Gas Cracker or Dual Feed Cracker
- Petro Fluid Catalytic Cracker or Petro FCC or Petro Residue FCC
- Deep Catalytic Cracker (DCC)
- Propane De Hydrogenation (PDH)

Propylene produced in FCC units is typically called Refinery Propylene. The proportion of Propylene used for producing PP has been consistently increasing in favour of Refinery Propylene since early 1990's. The Propylene produced irrespective of source as raw material for manufacturing PP resin is called Polymer Grade Propylene since it has to meet stringent specifications required for propylene polymerization reaction using Ziegler-Natta (ZN) family of catalysts. Typically polymer grade Propylene is 99.50 % V/V purity as minimum.

Indian Scenario – Current & Emerging

In India Reliance Industries Limited was the first refinery & petrochemicals complex to pioneer the production of polymer grade Refinery Propylene in late 1990's. All other PP units were based on Cracker Propylene until MRPL (Mangalore Refinery & Petrochemicals Limited) and HMEL (Hindustan Mittal Energy Limited) started producing PP using Refinery Propylene in 2010's

As of 2020, operating PP capacity in India is approx. 4.8 Million Metric Tonnes Per Annum (MMTPA) as compared to about 80 MMTPA globally which means about 6% of global.

Many Refiners in India have already initiated plans to foray in to petrochemicals to improve upon Gross Refining Margin (GRM). They are integrating refinery with PP either by installing Petro FCC or Cracker or combination of both. Of Course PP is not the only petrochemical product that is part of refinery integration but may also include Polyethylene or Mono Ethylene Glycol or Para Xylene or Purified Terephthalic Acid in different combinations.

The emerging PP capacities in India as per the information available in public domain is as follows:

Thus total of 4.60 MMTPA PP capacities are progressively expected to be commissioned starting from 2022 to 2024. Therefore let us assume that by 2025, PP capacity in India will increase from current 4.8 MMTPA to 4.80 + 4.60 = 9.40 MMTPA against expected global capacity of about 130 MMTPA that is about 7.2 % which is some improvement over 2020.

Year PP Capacity (MMTPA)		
2020	4.80	100%
2025	9.40	195%

This can be summarized in following manner:

Increase in 5 years by stupendous 95%! This surge roughly means that the PP capacity will practically double in a matter of just 5 years! Thus PP consumption in India which was thus far constrained by supply, will suddenly find abundant capacity to engine the growth of PP consumption from approximately 4 kg per capita to 8 kg per capita in 5 years.

As can be noted from the Table 1 above, these capacities will also be spread across the nation and will promote industrialization and benefit states like Rajasthan, Bihar and Odisha which did not have such plants. Thus states like Rajasthan, Bihar and Odisha are likely to share a significant growth in their areas which will boost the state economy in terms of investment, revenue and employment.

Similarly, another noteworthy aspect is that all the three major global PP technology licensors namely LyondellBasell (Bulk Slurry Phase Polymerization), Lummus

Table 2: Polypropylene (PP) - Typical Applications	
Type	**Typical Applications**
PP - Homopolymer	
Injection Moulding	Industrial Products, Furniture, Housewares, Rigid Packaging, Thin Wall Containers, Closures, Syringes
Extrusion	Pipes, Sheets, Therforming, Tubings, Blow Moulded Bottles Strappings
Tubular Quench Films (TQ Films)	Textile Overwraps, Garment Bags, Snack Food Packaging
Bi-axially Oriented PP Films (BOPP Films)	Lamination, Food Packaging, Adhesive Tapes, Synthetic Paper
Oriented Tapes	Woven Fabrics & Woven Sacks for Packaging, Sacks & FIBC for Outdoor Applications
Fibre Spinning	Staple Fibres, Carpets, Multifiment Yarn, Non-Woven Fabrics
PP - Random Copolymers	
Injection Moulding	Rigid Containers, Housewares, Syringes,
Blow Moulding	IV Fluid Bottles, High Clarity Bottles
Extrusion	Heat Seal Coating
PP - Impact Copolymers	
Injection Moulding	Furniture, Industrial Products, Automotive Parts, Luggage, Washing Machines Tubs, Batteries, Rigid Packaging, Appliances
Extrusion	Hollow Corrugated Sheets, Thermoforming

Applications of PP: The typical applications of PP resin are mentioned in the Table 2 below.

These PP applications have become inevitable part of our daily life style. While the products from all these licensors are well established in India to a large extent; the respective resin producers will have good competition among themselves to hard sell their products in emerging markets along with established existing players. The consistency in product quality and some uniqueness or differentiation or innovativeness in product range will be the key challenge for the new producers.

Novolen (Vertical Stirred Bed Gas Phase Polymerization) and W R Grace (Fluidized Bed Gas Phase Polymerization), will have their significant presence in India through these new plants.

The healthy competition will compel the producers to not only meet the highest product quality standards demanded by the market but also scout for speciality applications which they can serve.

Raw Materials for Manufacturing PP

Typically any such polymer plant requires three types of input raw materials.

- The major raw materials by volume are of course supplied within the complex for example propylene, ethylene, hydrogen etc.
- The second category of input chemicals are of proprietary nature for example main polymerization catalysts which is supplied by the Licensors.
- Third category of input raw materials are chemicals which are called co-catalysts for example aluminium alkyls, electron donors to control product quality and polymer additives. These are high value speciality chemicals which are imported as well as purchased locally.

Polymer additives form approximately 1% of the main resin that is 4.6 MMTPA of PP will need 46,000 TPA of polymer additives. This offers a great opportunity to manufacture these chemicals locally to a large extent thus providing challenging opportunity to existing producers as well as new entrants. Indigenous production of such chemicals will also take the clarion call of "Atmanirbhar" further.

PP Downstream Industry

Higher production capacity is also expected to translate in to large number of new plastic processors or plastic convertors who are first hand customers of PP resin producers.

Small to medium scale plastic processors form the bulk of the plastic industry in India. No doubt the existing processors will aim to enhance the capacity but nevertheless a large number of new plastic processing units are expected to come up or rather surge across India which will be a boost to the Indian economy. One can imagine that such plastic converters will be in excess of 10000 units across India.

Plastic Waste

With capacity doubling up, the problems arising out of plastic waste are also expected to rise. However, the problem is not because of plastic by itself but because of inadequate plastic recycle and disposal mechanism. Manufacture of Polypropylene is practically pollution free industry which is a great advantage. It is possible to think of installing incinerators on cooperative basis wherever possible for efficient disposal of plastic waste as is practised in the West. This can be alternate to plastic waste which cannot be recycled.

Conclusions

Polypropylene production is expected to double from current 4.8 MMTPA to 9.4 MMTPA in a matter of five years by 2025. This capacity surge will boost the consumption pattern of PP across the country by significantly penetrating the rural India. It will thus facilitate to boost the economy by investment, revenue generation and employment in addition to improvement in quality of everyday life. ■